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## Collinear ptychographic pulse reconstruction of ultrashort laser pulses

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Reconstruction of the phase and amplitude of ultrashort pulses are needed since no detector is fast enough to measure these pulses directly. Many methods to do so exist each with its own set of advantages and disadvantages. The only pulse reconstruction methodology which allows one to reconstruct the electric field at the sample plane in the focus of a collinear pulsed laser source, is the multiphoton intrapulse interference phase scan (MIIPS). The technique requires rescanning a specific phase pattern for multiple steps and thereby allowing extraction of the phase from the measurement. The process is repeated several times to improve the extracted phase until the deviation from the previous extracted phase is small enough to stop. We have adapted the time-domain ptychographic reconstruction algorithm to take a MIIPS trace as an input and reconstruct the full electric field with the advantage that only a single scan needs to be taken where after the measure spectrogram is passed to the Ptycho-MIIPS reconstruction algorithm. Ptycho-MIIPS has the advantage that it returns not only the phase but also the amplitude of the electric field, unlike MIIPS which only returns the phase.

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